<u>IN THE CLAIMS</u>

1. **(currently amended)** A communications device for communication over wireless channels, comprising:

a complex time-domain response measurement unit that obtains, at radio frame intervals, complex time-domain response signals representing characteristics of propagation paths;

a phase difference calculator that calculates absolute phase differences between the complex time-domain response signals that are selected;

an average operator that calculates a mean value of the absolute phase differences over a plurality of radio frames; and

a Doppler frequency estimator that estimates Doppler frequency by dividing the mean value by ~~the~~ <u>a</u> time length of <u>one of</u> the radio frame<u>s</u>.

2. (original) The communications device according to claim 1, wherein said complex time-domain response measurement unit calculates the complex time-domain response signals from known pilot symbols or synchronous channel signals which are multiplexed on each radio frame.

3. (original) The communications device according to claim 1, wherein said phase difference calculator extracts a maximum complex time-domain response signal of an (n-1)th frame, identifies a time position of the extracted maximum complex time-domain response signal, and calculates an absolute phase difference between the maximum complex time-domain response signal of the (n-1)th frame and a complex time-domain response signal at the identified time position of an nth frame.

4. (original) The communications device according to claim 1, wherein said phase difference calculator selects one of the complex time-domain response signals, identifies a time position of the selected complex time-domain response signal, extracts complex time-domain response signals at the identified time position in consecutive radio frames, and calculates absolute phase differences between the extracted complex time-domain response signals.

5. (original) The communications device according to claim 1, wherein said phase difference calculator calculates average power of complex time-domain response signals at each different time position over a plurality of frames within an averaging interval, identifies a time position at which the average power hits a peak, extracts complex time-domain response signals at the identified time position in consecutive radio frames, and calculates absolute phase differences between the extracted complex time-domain response signals.

6. **(currently amended)** A communications device for communication over wireless channels, comprising:

a complex time-domain response measurement unit that obtains complex time-domain response signals from a received signal at radio frame intervals, the complex time-domain response signals representing characteristics of propagation paths, the received signal being affected by a frequency offset;

a phase difference calculator that calculates signed phase differences and absolute phase differences between the complex time-domain response signals that are selected;

a first average operator that obtains a first mean value by averaging the absolute phase differences over a plurality of radio frames;

a second average operator that obtains a second mean value by averaging the signed phase differences over the plurality of radio frames;

a frequency offset estimator that estimates the frequency offset by dividing the second mean value by ~~the~~ a time length of one of the radio frames;

an automatic frequency control (AFC) unit that reduces effects of the frequency offset, based on the estimated frequency offset; and

a Doppler frequency estimator that estimates Doppler frequency by dividing the first mean value by the time length ~~of the radio frame~~.

7. (original) The communications device according to claim 6, wherein said complex time-domain response measurement unit calculates the complex time-domain response signals from known pilot symbols or synchronous channel signals which are multiplexed on each radio frame.

8. (original) The communications device according to claim 6, wherein said phase difference calculator extracts a maximum complex time-domain response signal of an (n-1)th frame, identifies a time position of the extracted maximum complex time-domain response signal, and calculates a signed phase difference and an absolute phase difference between the maximum complex time-domain response signal of the (n-1)th frame and a complex time-domain response signal at the identified time position of an nth frame.

9. (original) The communications device according to claim 6, wherein said phase difference calculator selects one of the complex time-domain response signals, identifies a time position of the selected complex time-domain response signal, extracts complex time-domain response signals at the identified time position in consecutive radio frames, and

calculates signed phase differences and absolute phase differences between the extracted complex time-domain response signals.

10. (original) The communications device according to claim 6, wherein said phase difference calculator calculates average power of complex time-domain response signals at each different time position over a plurality of frames within an averaging interval, identifies a time position at which the average power hits a peak, extracts complex time-domain response signals at the identified time position in consecutive radio frames, and calculates signed phase differences and absolute phase differences between the extracted complex time-domain response signals.

11. **(currently amended)** An orthogonal frequency division multiplexing (OFDM) receiver that receives an OFDM-modulated signal, comprising:

a complex time-domain response measurement unit that estimates subcarrier channels for each radio frame and obtains complex time-domain response signals by performing inverse Fourier transform on all the subcarrier channel estimates;

a phase difference calculator that calculates absolute phase differences between the complex time-domain response signals that are selected;

an average operator that calculates a mean value of the absolute phase differences over a plurality of radio frames; and

a Doppler frequency estimator that estimates Doppler frequency by dividing the mean value by ~~the~~ a time length of one of the radio frames.

12. (original) The OFDM receiver according to claim 11, wherein said complex time-domain response measurement unit calculates the complex time-domain response signals

from known pilot symbols or synchronous channel signals which are multiplexed on each radio frame.

13. (original) The OFDM receiver according to claim 11, wherein said phase difference calculator extracts a maximum complex time-domain response signal of an (n-1)th frame, identifies a time position of the extracted maximum complex time-domain response signal, and calculates an absolute phase difference between the maximum complex time-domain response signal of the (n-1)th frame and a complex time-domain response signal at the identified time position of an nth frame.

14. (original) The OFDM receiver according to claim 11, wherein said phase difference calculator selects one of the complex time-domain response signals, identifies a time position of the selected complex time-domain response signal, extracts complex time-domain response signals at the identified time position in consecutive radio frames, and calculates absolute phase differences between the extracted complex time-domain response signals.

15. (original) The OFDM receiver according to claim 11, wherein said phase difference calculator calculates average power of complex time-domain response signals at each different time position over a plurality of frames within an averaging interval, identifies a time position at which the average power hits a peak, extracts complex time-domain response signals at the identified time position in consecutive radio frames, and calculates absolute phase differences between the extracted complex time-domain response signals.

16. **(currently amended)** An orthogonal frequency division multiplexing (OFDM) receiver that receives an OFDM-modulated signal, comprising:

a complex time-domain response measurement unit that estimates subcarrier channels for each radio frame of a received signal and obtains complex time-domain response signals by performing inverse Fourier transform on all the subcarrier channel estimates, the received signal being affected by a frequency offset;

a phase difference calculator that calculates signed phase differences and absolute phase differences between the complex time-domain response signals that are selected;

a first average operator that obtains a first mean value by averaging the absolute phase differences over a plurality of radio frames;

a second average operator that obtains a second mean value by averaging the signed phase differences over the plurality of radio frames;

a frequency offset estimator that estimates the frequency offset by dividing the second mean value by ~~the~~ a time length of one of the radio frames;

an automatic frequency control (AFC) unit that reduces effects of the frequency offset, based on the estimated frequency offset; and

a Doppler frequency estimator that estimates Doppler frequency by dividing the first mean value by the time length~~ of the radio frame~~.

17. (original) The OFDM receiver according to claim 16, wherein said complex time-domain response measurement unit calculates the complex time-domain response signals from known pilot symbols or synchronous channel signals which are multiplexed on each radio frame.

18. (original) The OFDM receiver according to claim 16, wherein said phase difference calculator extracts a maximum complex time-domain response signal of an (n-1)th frame, identifies a time position of the extracted maximum complex time-domain response signal, and calculates a signed phase difference and an absolute phase difference between the maximum complex time-domain response signal of the (n-1)th frame and a complex time-domain response signal at the identified time position of an nth frame.

19. (original) The OFDM receiver according to claim 16, wherein said phase difference calculator selects one of the complex time-domain response signals, identifies a time position of the selected complex time-domain response signal, extracts complex time-domain response signals at the identified time position in consecutive radio frames, and calculates signed phase differences and absolute phase differences between the extracted complex time-domain response signals.

20. (original) The OFDM receiver according to claim 16, wherein said phase difference calculator calculates average power of complex time-domain response signals at each different time position over a plurality of frames within an averaging interval, identifies a time position at which the average power hits a peak, extracts complex time-domain response signals at the identified time position in consecutive radio frames, and calculates signed phase differences and absolute phase differences between the extracted complex time-domain response signals.

21. **(currently amended)** A method of estimating Doppler frequency that occurs in proportion to speed of a mobile station, the method comprising the steps of:

(a) obtaining, at radio frame intervals, complex time-domain response signals representing characteristics of propagation paths;

(b) calculating absolute phase differences between the complex time-domain response signals that are selected;

(c) calculating a mean value of the absolute phase differences over a plurality of radio frames; and

(d) estimating Doppler frequency by dividing the mean value by ~~the~~ a time length of one of the radio frames.

22. (original) The method according to claim 21, wherein said signal obtaining step (a) calculates the complex time-domain response signals from known pilot symbols or synchronous channel signals which are multiplexed on each radio frame.

23. (original) The method according to claim 21, wherein said difference calculating step (b) comprises the substeps of:

extracting a maximum complex time-domain response signal of an (n-1)th frame;

identifying a time position of the extracted maximum complex time-domain response signal; and

calculating an absolute phase difference between the maximum complex time-domain response signal of the (n-1)th frame and a complex time-domain response signal at the identified time position of an nth frame.

24. (original) The method according to claim 21, wherein said difference calculating step (b) comprises the substeps of:

selecting one of the complex time-domain response signals;

identifying a time position of the selected complex time-domain response signal;

extracting complex time-domain response signals at the identified time position in consecutive radio frames; and

calculating absolute phase differences between the extracted complex time-domain response signals.

25. (original) The method according to claim 21, wherein said difference calculating step (b) comprises the substeps of:

calculating average power of complex time-domain response signals at each different time position over a plurality of frames within an averaging interval;

identifying a time position at which the average power hits a peak;

extracting complex time-domain response signals at the identified time position in consecutive radio frames; and

calculating absolute phase differences between the extracted complex time-domain response signals.

26. (original) The method according to claim 21, wherein:

the mobile station receives an OFDM-modulated signal; and

said signal obtaining step (a) comprises the substeps of:

estimating subcarrier channels for each radio frame, and

obtaining complex time-domain response signals by performing inverse Fourier transform on all the subcarrier channel estimates.

27. **(currently amended)** A method of estimating Doppler frequency that occurs in proportion to speed of a mobile station, the method comprising the steps of:

(a) obtaining complex time-domain response signals from a received signal at radio frame intervals, the complex time-domain response signals representing characteristics of propagation paths, the received signal being affected by a frequency offset;

(b) calculating signed phase differences and absolute phase differences between the complex time-domain response signals that are selected;

(c) obtaining a first mean value by averaging the absolute phase differences over a plurality of radio frames;

(d) obtaining a second mean value by averaging the signed phase differences over the plurality of radio frames;

(e) estimating the frequency offset by dividing the second mean value by ~~the~~ a time length of one of the radio frames;

(f) reducing effects of the frequency offset, based on the estimated frequency offset; and

(g) estimating Doppler frequency by dividing the first mean value by the time length ~~of the radio frame~~.

28. (original) The method according to claim 27, wherein said signal obtaining step (a) calculates the complex time-domain response signals from known pilot symbols or synchronous channel signals which are multiplexed on each radio frame.

29. (original) The method according to claim 27, wherein said difference calculating step (b) comprises the substeps of:

extracting a maximum complex time-domain response signal of an (n-1)th frame;

identifying a time position of the extracted maximum complex time-domain response signal; and

calculating a signed phase difference and an absolute phase difference between the maximum complex time-domain response signal of the (n-1)th frame and a complex time-domain response signal at the identified time position of an nth frame.

30. (original) The method according to claim 27, wherein said difference calculating step (b) comprises the substeps of:

selecting one of the complex time-domain response signals;

identifying a time position of the selected complex time-domain response signal;

extracting complex time-domain response signals at the identified time position in consecutive radio frames; and

calculating signed phase differences and absolute phase differences between the extracted complex time-domain response signals.

31. (original) The method according to claim 27, wherein said difference calculating step (b) comprises the substeps of:

calculating average power of complex time-domain response signals at each different time position over a plurality of frames within an averaging interval;

identifying a time position at which the average power hits a peak;

extracting complex time-domain response signals at the identified time position in consecutive radio frames; and

calculating signed phase differences and absolute phase differences between the extracted complex time-domain response signals.

32. (original) The method according to claim 27, wherein:

the mobile station receives an OFDM-modulated signal; and

said signal obtaining step (a) comprises the substeps of:

estimating subcarrier channels for each radio frame, and

obtaining complex time-domain response signals by performing inverse Fourier transform on all the subcarrier channel estimates.